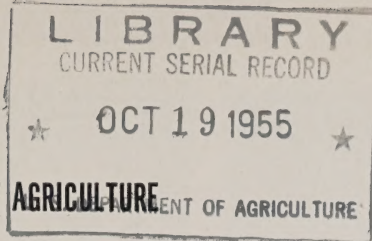


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U. S. DEPARTMENT OF AGRICULTURE  
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FOREST PEST LEAFLET 2  
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## The Mountain Pine Beetle

By George R. Struble and Philip C. Johnson  
California Forest and Range Experiment Station

The mountain pine beetle (*Dendroctonus monticolae* Hopk.) is one of the most destructive forest insects in western United States and Canada. Since 1910 it has killed many billion board-feet of commercial timber. Single infestations have almost totally depleted merchantable lodgepole pine forests in Montana and Idaho. In these States, and also in Washington and Oregon, western white pine has been severely attacked, and in California the destruction of sugar pine alone is estimated to be in excess of 5 billion board-feet.

Infestations in pure stands of lodgepole pine in the Rocky Mountains, Cascade Mountains, and Sierra Nevada often develop rapidly and maintain epidemic status until every tree over 3 inches in diameter is killed. In mature sugar pine and western white pine forests, infestations are more often limited to single trees or small groups of trees. Although they frequently subside naturally after killing a comparatively small part of the stand, repeated and sometimes almost chronic outbreaks eventually cause serious stand depletion.

The beetle is found over a wide range from the Pacific coast eastward to western Nevada, northern Utah, the western parts of Wyoming and Montana, western Alberta, and southward to the San Pedro Martir Mountains in Baja Cali-

fornia (fig. 1). It ranges in elevation from 2,000 feet above sea level in the northern latitudes to as high as 12,000 feet in the southern latitudes. It is closely related and is similar in habit to the Black Hills beetle (*D. ponderosae* Hopk.), which is a serious killer of pon-

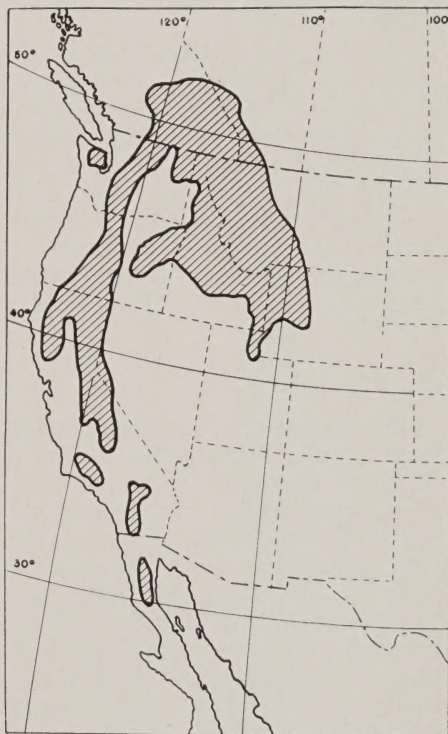


Figure 1.—Infestation areas of the mountain pine beetle in western United States, Canada, and Baja California.



derosa pine in the Black Hills of South Dakota and in the southern Rocky Mountain region.

### Host Trees

Western white pine, sugar pine, and lodgepole pine are preferred hosts, but attacks in ponderosa pine, whitebark pine, and limber pine sometimes cause extensive killing of these host trees.

### Evidences of Infestation

Infested trees start fading within a few weeks to a year after attack. The foliage changes from green to yellowish green, sorrel, and reddish brown. The rate of fading is influenced by a number of factors—tree species, season and intensity of attack, and climatic conditions are important. In the warmer part of its range, sugar pine begins to fade sooner than similarly attacked western white pine or lodgepole pine.

Newly infested trees may be detected by pitch tubes and boring dust in the bark crevices. Pitch tubes are masses of reddish, amorphous resin mixed with bark and wood borings, and vary from  $\frac{1}{2}$  to  $\frac{3}{4}$  inch across. Each tube marks a beetle entrance or attack and is formed in an attempt to rid tunnels of resins exuding from initial wounds.

### Description

The beetle passes through the egg, larval, pupal, and adult stages in its development. The minute, pearly-white eggs hatch into yellowish-white, legless grubs or larvae. After passing through three instars the larvae transform into pupae and then into adults. Newly formed adults are yellowish brown at first but turn pitch black at maturity. These short-legged, stout, cylindrical creatures, about  $\frac{3}{16}$  inch long, can fly readily to new host trees.

### Life History

The wide distribution of the beetle accounts for considerable variation in its life history. One generation emerges annually in most of the range. The beetle attacks during June, July, and August. The resulting broods overwinter as new adults and mature as young larvae. Two generations a year and often the beginning of a third develop in the relatively warm climates below the 7,000-foot elevation southward from latitude 40° North.

### Habits

Parent adult beetles attack by boring through the bark to the inner surface, then tunnel upward to form the egg gallery, which often extends for a distance of 30 inches or more. In sugar pine the galleries are often irregular and winding. Eggs are placed along each side of the gallery in individual niches (fig. 2, *A*). Both the niches and egg galleries are tightly packed with partially digested woody particles, or frass.

Heavily attacked trees contain egg galleries spaced 1 to 2 inches or more apart around the entire main trunk. The attacks occur from near the ground upward to about a 6-inch diameter at the top. In sugar pine and white pine they often extend into the larger limbs. In lodgepole pine the initial attacks are concentrated in the lower trunk, and later attacks by secondary species of bark beetles affect the upper part.

After hatching, the larvae (fig. 2, *B*) feed constantly on the inner bark or phloem in individual channels. Their larval mines extend 1 to 5 inches at right angles from the egg gallery. The larvae then excavate shallow, oval pits in which they transform into pupae (fig. 2, *C*) and later into adults (fig. 2, *D*). As the new adults mature, they

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Page

- 2     Line 8, "adults and mature as young larvae.",  
should read "adults and mature and young  
larvae." (Column 2.)

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1. Line 8. "and" should be "young" and "young" should be "adults" and "adults" should be "young".

(Article 7, Paragraph 4)

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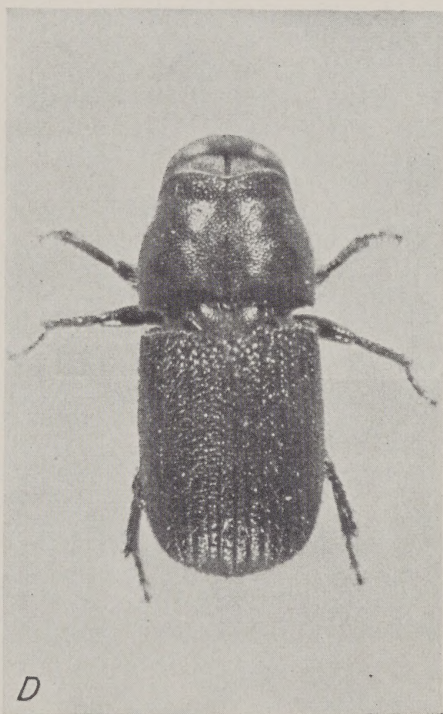


Figure 2.—Mountain pine beetle: A, Eggs; B, larva; C, pupa; D, adult.



emerge from these cells or from interconnecting cavities by boring to the outer bark surface.

## Natural Control

Parasites, predators, and weather are important for the natural control of the beetle. Predaceous insects and woodpeckers are particularly effective. Predators and parasites become fully effective when their populations have multiplied, after the beetle upbuild. Thus they may not exert their full force until considerable damage has been done to the forests. Unseasonably low temperatures kill the beetles but occur too seldom to be reliable.

## Applied Control Measures

In white pine, preliminary evidence indicates that the removal of low-vigor trees helps to prevent outbreaks. In sugar pine, however, studies thus far reveal no significant correlation between the frequency of attacks and the age, vigor, or crown character of the trees. Much additional research is needed in both timber types before selective cutting can be used with confidence as a control measure.

Infestation of windthrown timber or of large-diameter slash from logging or clearing has often led to outbreaks. These can be prevented through prompt cleanup of such material by salvage logging, limbing, peeling, and burning.

Direct control methods to destroy broods are widely used. Toxic, bark-penetrating sprays applied to infested trunks are successful in western white pine, lodgepole pine, and second-growth sugar pine. The formula used most commonly is 1 part of orthodichlorobenzene to 5 parts of diesel oil. However, ethylene dibromide in a less costly formulation (1½ pounds in 5 gallons

of diesel oil) on second-growth sugar pine and ponderosa pine showed greater killing power in recent tests. This formula may eventually replace others for all host species.

Enough spray is applied to saturate the bark surface of felled or standing trees. It penetrates to inner surfaces and kills broods by fumigation and contact. With modern equipment, effective spraying of standing trees is possible up to 35 feet above the ground. The taller trees of all host species usually contain broods well above this level, and consequently must be felled before spraying. Thorough treatment often requires limbing and rolling the logs to spray all sides.

No toxic sprays yet developed will penetrate far enough to kill broods beneath the thick bark of old-growth sugar pine and white pine. Such infested trees must be felled, and the bark peeled and burned.

The sun's heat is sometimes used successfully against beetle broods in trees having thin bark. Infested trees are felled and limbed, and the logs are placed so as to lie in a north-south direction. The stand must be open, the air temperature must be over 70° F., and the sun's rays must be at an angle suitable for effective warming. After exposure has killed broods in the upper side of a log, it is rolled over to bring the other side uppermost.

## Reference

THE MOUNTAIN PINE BEETLE, AN IMPORTANT ENEMY OF WESTERN PINES. James C. Evenden, W. D. Bedard, and G. R. Struble. U. S. Dept. Agr. Cir. 664, 25 pp., illus. 1943. (Out of print; may be consulted in libraries.)